

Remarks

The Examiner states that the Oath/Declaration is defective as not identifying the mailing or post office address of each inventor. The Declaration enclosed herewith identifies the mailing address. The Examiner rejected claim 16 as lacking antecedent for "said vacuum" in line 2. Claim 16 has been amended to depend from claim 12 rather than claim 11 wherein "vacuum" is introduced.

The Examiner rejected claims 1-19 as being unpatentable over Ohsaki et al 5856043 in view of Nakagiri et al 6558841.

The Examiner states that the present application is directed to an anode for a lithium battery wherein the disclosed inventive concept comprises the specific weight carbon fibres.

Applicant respectfully disagrees with the Examiner's characterization of the invention.

Applicant's invention is the addition of carbon fibres to an anode for a lithium battery principally comprising a pressed compact spherical graphite. The invention is not so much in the specific weight percent as in the realization a relatively small addition of carbon nano-fibres may greatly enhance the performance characteristics of an anode which is principally spherical graphite powder. A further aspect of the invention is recognizing how using carbon nano-fibres which have been heated in a partial vacuum yields even further significant cycle life increases.

The Ohsaki reference teaches making an anode entirely from graphitic nano-fibres, grown in an inert gas phase at very high temperatures (2800°C see col.1 lines 17-18) for the anode-active material in a rechargeable lithium battery. As may be expected, such fibres work well in an electrode in lieu of spherical graphite. Such fibres are however a very expensive commercial product by virtue of the preparation process.

In contrast, Applicant's anode does not seek to replace spherical graphite with fibrous graphite but rather utilizes a relatively small addition of carbon nano-fibres to an otherwise spherical graphite structure. As set out on page 6 at lines 4-6 of the present application, cost considerations currently favour a range of between 2-2.5% by weight of the carbon nano-fibres.

This is a significant departure from Ohsaki which teaches substituting the spherical graphite for fibrous graphite.

The Examiner states that Ohsaki et al also teach the spherical graphite which is a meso-carbon microbeads and a meso-carbon fibre (col. 3, lines 61-63). In reviewing the cited passage, Applicant notes that Ohsaki does not suggest using spherical graphite, but rather distinguishes spherical graphite from the carbon fibres which Ohsaki advocates using. The full sentence in which spherical graphite is referred to reads as follows:

“In the other words, [sic] if the graphitized vapour-grown carbon fibres have a specific surface area of not more than 5 m²/g they are advantageous compared with a plate-like graphite, a spherical graphite is [sic] such as meso-carbon microbeads and a meso-carbon fibre.” emphasis added.

The Examiner states that with respect to claims 2 and 9 Ohsaki discloses vapour-grown fibres having a diameter no greater than 70 nm and further with respect to claims 4 and 11 and the carbon fibres are vapour-grown carbon fibres. Applicant respectfully submits that regardless of how the Ohsaki fibres are formed Ohsaki makes no suggestion of introducing a relatively small proportion of carbon fibres in a substantially spherical electrode or that very significant performance differences may be achieved.

The Examiner states with respect to claims 5-6, 12-13 and 15-18 that Applicant has introduced a method limitation i.e. having the nano-fibres subjected to specific vacuum and heat treatment. Applicant respectfully submits that this is not a method limitation incorporated into a product claim but rather goes to the properties of one of the components in the product. In other words, the vacuum and heat treatment desorbs moisture and other impurities present on the surface of the graphitic components and the claim specifies using such treated fibres as a component of the product. Applicant submits that this is analogous for example to specifying an anhydrous compound as a constituent of a mixture as such language doesn't go to the preparation of the mixture but to the makeup of one of the components.

The Examiner points out that Ohsaki does not disclose the specific weight percent of carbon fibres and the specific average diameter and length of the graphite carbon. The Examiner however suggests that Nakagiri teaches specific examples wherein the percentage of fibrous carbon is 1%, 10% and 20% as well as the length being approximately 10 microns and having a diameter of about 200 nano-metres. The Examiner concludes that it would have been obvious to one skilled in the art to include the specific weight percent of the carbon fibre of Nakagiri in the anode of Ohsaki.

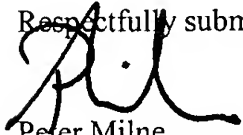
Applicant respectfully points out that Nakagiri does not teach a negative electrode consisting substantially of spherical carbon. In contrast, Nakagiri teaches a tin containing inter-metallic compound. See for example the Summary of the Invention, col. 5, lines 23 through 30 and the claims. Furthermore, although the dimensions of the carbon being used in Nagakiri may be within the specified ranges, Nagakiri uses a different kind of carbon which would have a different crystalline nature than that of the present invention or Ohsaki.

The Examiner states that it would be obvious to include the specific weight percent of the carbon fibre of Nakagiri and the anode of Ohsaki. Applicant respectfully disagrees on the basis that this would be impossible. Ohsaki teaches an anode made up of carbon fibres. Were from 80 to 99% of those fibres be removed, with what would they be replaced? The only other component in the Ohsaki electrode is the polymeric binder. Accordingly the suggested combination would yield an anode made up of substantially of a polymeric binder rather than spherical graphite with a small percentage of fibres. This is not Applicant's claimed structure. Furthermore such an anode would be useless in a lithium battery.

In summary, Applicant respectfully submits that the cited references are not combinable to yield the invention as claimed in claim 1 of the present invention. As the remaining claims depend directly or indirectly from claim 1, it follows that the cited references are not combinable to yield the invention of the remaining claims. Accordingly, for the reasons set out above, Applicant respectfully submits that the application as amended is in condition for allowance and action towards that goal is respectfully requested.

Should the Examiner have any questions which might be more efficiently dealt with over the phone, the Examiner is invited to contact Applicant's agent at the number set out below.

Respectfully submitted,

A handwritten signature in black ink, appearing to be 'P. Milne', written over the text 'Respectfully submitted,'.

Peter Milne

Registration No. 34,534

Tel.: (416) 862-5790

PM:mym

Enc.

[TOR_LAW5575285\1]